

AD-A155 492 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS 1/1
NORTON RESERVOIR DAM C. (U) CORPS OF ENGINEERS WALTHAM
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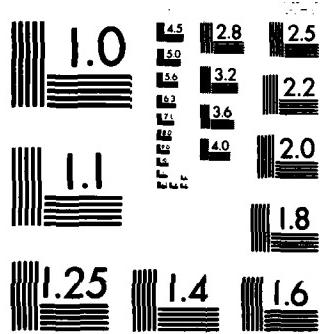
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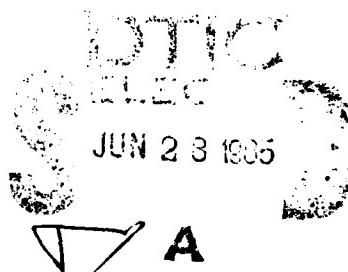
COASTAL BASIN
NORTON, MASSACHUSETTS

NORTON RESERVOIR DAM

MA 00815

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS 02154

AUGUST 1978

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:
NEDED

SEP 28 1978

Honorable Michael S. Dukakis
Governor of the Commonwealth of
Massachusetts
State House
Boston, Massachusetts 02133

Dear Governor Dukakis:

I am forwarding to you a copy of the Norton Reservoir Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Quality Engineering, the cooperating agency for the Commonwealth of Massachusetts. In addition, a copy of the report has also been furnished the owner, The Wading Reservoir Corporation, 620 Spring Street, North Dighton, Massachusetts 02764.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Quality Engineering for your cooperation in carrying out this program.

Sincerely yours,

X-100-100
JOHN P. CHANDLER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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| 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) DAMS, INSPECTION, DAM SAFETY, Coastal Basin Norton, Massachusetts Rumford River | | |
| 20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The complex spillway is 77 ft. long and stands 12 ft. above stream bed at its lowest point. There are several houses close to the water's edge and in the watercourse downstream of the dam. The structure appears to be in fair condition, as is the left abutment and gatehouse. Owing to the impoundment storage, the dam falls within the intermediate size category. The hazard potential is significant. A failure of the dam coincident with full spillway discharge could result in a flow of about 7000 cfs. | | |

NORTON RESERVOIR DAM

MA 00815

COASTAL BASIN
NORTON, MASSACHUSETTS

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

Identification No.: MA 00815

Name of Dam: Norton Reservoir Dam

Town: Norton, Massachusetts

County and State: Bristol County, Massachusetts

Stream: Rumford River

Date of Inspection: June 12, 1978

BRIEF ASSESSMENT

The Norton Reservoir Dam is an almost 80-year old concrete overflow structure with earthfill abutments behind concrete wing walls. No details of the design or construction are known. The complex spillway is 77 feet long and stands 12 feet above stream bed at its lowest point. Freeboard between this level and the top of the dam is 4 to 5 feet. The reservoir is used for industrial purposes. There are several houses close to the water's edge and in the watercourse downstream of the dam. Water is released in the Spring and Fall of the year in anticipation of high flows.

The structure appears to be in fair condition, as is the left abutment and gatehouse. The right abutment shows signs of erosion and could well be the first section to fail.

Owing to the impoundment storage, Norton Reservoir Dam falls within the intermediate size classification. It is in the significant hazard potential category and thus hydraulically analyzed using the full probable maximum flood.

Reservoir storage will reduce the probable maximum discharge of 10,970 cfs to a test flood of 9,300 cfs. The spillway can pass, before overtopping, about 1,600 cfs (17 percent of the test flood). In the event of the test flood, the abutments would be overtopped by some 3 to 4 feet. Failure of the dam during test flood would not materially increase the flow as water level immediately downstream at that time would be within a few feet of the spillway crest.

A failure of the dam coincident with full spillway discharge could result in a flow of about 7,000 cfs. Such a flow might cause flooding in dwellings on the banks of the watercourse but would not, it appears, cause major damage or threaten human life.

Additional investigations or major modifications are not required. However, the owner should implement inspection and maintenance procedures, make repairs as required, clear the watercourse immediately downstream of the dam of growth and debris, restore the right abutment to true dimensions, and develop a flood warning system.



Gustav A. Diezemann, P. E.
New York State Lic. 027062

This Phase I Inspection Report on Norton Reservoir Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Charles G. Tiersch
CHARLES G. TIERSCH, Chairman
Chief, Foundation and Materials Branch
Engineering Division

Fred J. Ravens, Jr.
FRED J. RAVENS, Jr., Member
Chief, Design Branch
Engineering Division

Saul Cooper
SAUL COOPER, Member
Chief, Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar
JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

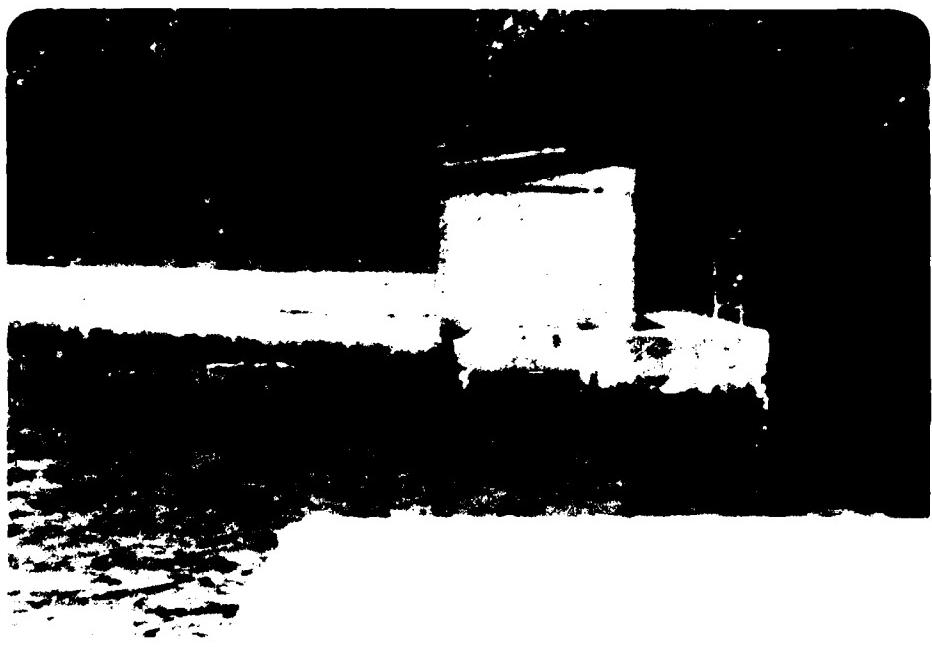
In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

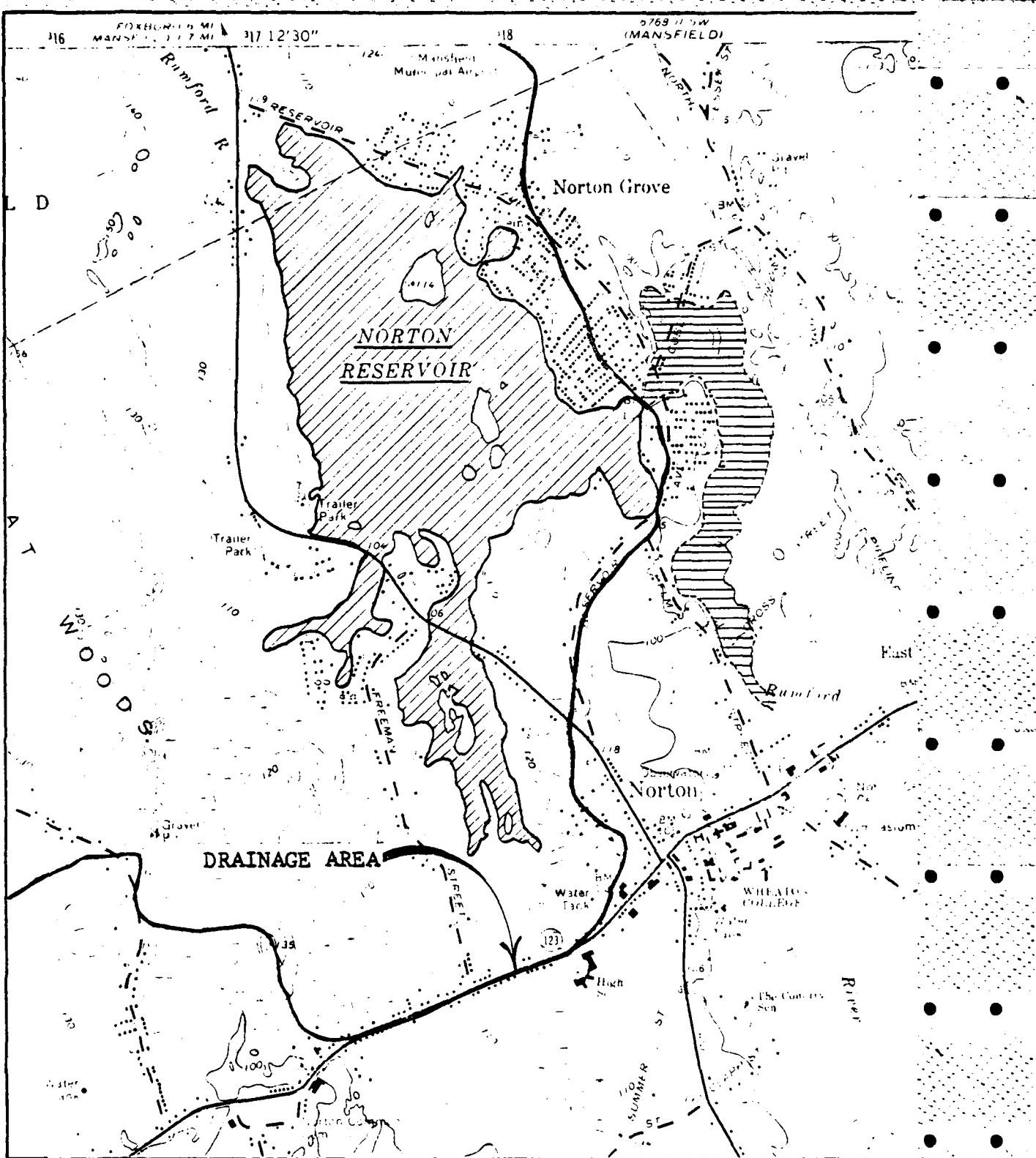
Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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OVERVIEW PHOTO



NORTON RESERVOIR

NORTON, MASS.
Scale 1:24000

PHASE I INSPECTION REPORT

NORTON RESERVOIR DAM

SECTION I

PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Chas. T. Main, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Massachusetts. Authorization and notice to proceed were issued to Chas. T. Main, Inc. under a letter of May 3, 1978, from Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW33-78-D328 has been assigned by the Corps of Engineers for this work.

b. Purpose.

(1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

(2) Encourage and prepare the states to initiate quickly effective dam safety programs for non-Federal dams.

(3) To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location. The Norton Reservoir Dam on the Rumford River is in the Town of Norton, Bristol County, Massachusetts.

b. Description of Dam and Appurtenances. The dam consists of a complex (see calculations) concrete gravity overflow section, 77 feet wide, with earthfill abutments behind concrete wing walls. If the dam is overtopped, these abutments and their natural extensions amount to effective discharge lengths of 100 feet and 250 feet on the right and left banks, respectively. The lowest overflow section is 12 feet above

stream bed. Controls for two sluice gates are housed in a small structure on the left abutment.

c. Size Classification. Owing to its storage capacity of about 3600 acre feet, the dam falls within the intermediate size classification.

d. Hazard Classification. As there are only a small number of houses downstream of the dam which could be endangered if the dam failed, the dam is considered to have a significant hazard potential.

e. Ownership. The dam is owned by the Wading River Reservoir Corporation located at 620 Spring Street, North Dighton, Massachusetts.

f. Operator. Mr. Joseph Coelho
613 School Street, North Dighton, Mass.
Home: (617) 823-3602. Office: (617) 824-7511

g. Purpose of Dam. The water impounded by the dam is used for industrial purposes downstream of the dam.

h. Design and Construction History. Nothing is known of the design and construction history of the dam, other than it was constructed about 1900.

i. Normal Operating Procedures. In anticipation of increased flows, water is released and the reservoir drawn down in the Spring and Fall of the year.

1.3 Pertinent Data

a. Drainage Area. The Norton Reservoir has approximately 18.72 square miles of drainage area of essentially flat, marshy, partially forested rural land.

b. Discharge at Damsite.

(1) The outlet works consist of two 30-inch diameter conduits controlled by sluice gates. This equipment was overhauled by the owner as recently as two years ago.

(2) The magnitude of the maximum flood which has occurred at the damsite is unknown.

(3) The ungated spillway capacity before the dam is overtopped is about 1,600 cfs, or approximately 17 percent of the test flood.

(4) There is no gated spillway capacity.

(5) There is no gated spillway capacity.

(6) The total spillway capacity at maximum pool elevation is 1,600 cfs at El. 105.

c. Elevation (Feet Above MSL)

| | |
|---|-------------------|
| (1) Top of dam | El. 106 |
| (2) Maximum design surcharge | El. 106 |
| (3) Full flood control pool | N/A |
| (4) Recreation pool | N/A |
| (5) Spillway crest (gated) | El. 101 (ungated) |
| (6) Upstream portal invert diversion tunnel | N/A |
| (7) Streambed at centerline of dam | El. 89 \pm |
| (8) Maximum tailwater | El. 98 \pm |

d. Reservoir (Feet)

| | |
|----------------------------------|--------------|
| (1) Length of maximum pool | 11,000 \pm |
| (2) Length of recreation pool | N/A |
| (3) Length of flood control pool | N/A |

e. Storage (Acre-Feet)

| | |
|------------------------|-------------|
| (1) Recreation pool | 3,600 \pm |
| (2) Flood control pool | N/A |
| (3) Design surcharge | 6,000 \pm |
| (4) Top of dam | 6,000 \pm |

f. Reservoir Surface (Acres)

| | |
|------------------------|-----------|
| (1) Top of dam | 816 \pm |
| (2) Maximum pool | 816 \pm |
| (3) Flood control pool | N/A |
| (4) Recreation pool | N/A |
| (5) Spillway crest | 600 |

g. Dam

- | | | |
|------|-----------------|------------------------------|
| (1) | Type | Concrete |
| (2) | Length | 77 \pm feet plus abutments |
| (3) | Height | 17 \pm feet |
| (4) | Top Width | Varies |
| (5) | Side slope | N/A |
| (6) | Zoning | N/A |
| (7) | Impervious core | N/A |
| (8) | Cutoff | Unknown |
| (9) | Grout curtain | Unknown |
| (10) | Other | N/A |

h. Spillway

- | | | |
|-----|-----------------|------------------------------|
| (1) | Type | Compound ungated weir |
| (2) | Length of weir | 77 \pm |
| (3) | Crest elevation | Lowest section El. 101 \pm |
| (4) | Gates | None |
| (5) | U/S Channel | N/A |
| (6) | D/S Channel | Stream bed |
| (7) | General | N/A |

i. Regulating Outlets. The outlet works consist of two 36-inch diameter conduits controlled by manually operated sluice gates.

SECTION 2
ENGINEERING DATA

2.1 Design

No design data exist.

2.2 Construction

There are no construction records available.

2.3 Operation

Other than it is known that the reservoir is drawn down in the Spring and Fall, no operation data exist.

2.4 Evaluation

a. Availability. There are no engineering data available.

b. Adequacy. The lack of in-depth engineering data does not allow for a definitive review. Therefore, the adequacy of this dam, structurally and hydraulically, cannot be assessed from the standpoint of review of design calculations, but must be based primarily on the visual inspection, past performance history, and sound hydrologic and hydraulic engineering judgment.

c. Validity. The limited data available do not furnish a proper basis for a detailed evaluation of this dam.

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. General. The Norton Reservoir Dam, considering its age of almost 80 years, is in fair condition. It is virtually impossible to ascertain where the embankment or fill behind the concrete wing walls ends and the natural grade begins.

b. Dam. The concrete, although old and weathered, appears to be structurally sound. Small amounts of seepage were observed at the wing walls. No significant horizontal or vertical misalignments were noticeable. The left abutment appears sound and well maintained. The right abutment is easily accessible to the public and shows signs of usage, there being footpaths and some erosion on the downstream slope.

c. Appurtenant Structures. The only appurtenant structure, the gatehouse, is in fair condition.

d. Reservoir Area. The banks are flat and wooded. There are several houses close to the water's edge.

e. Downstream Channel. The channel immediately downstream of the dam is rocky and partially filled with trees and other vegetation. There are several houses just downstream of the left abutment and its natural extension. About 100 yards downstream of the dam is a highway bridge. Beyond the bridge the stream follows a comparatively narrow course, with houses on either bank, before discharging into a broad, semi-wooded marsh which continues downstream at a right angle to the original flow. There are several houses on the periphery of the marsh and a small industrial pond and factory on the river course.

3.2 Evaluation

Based on visual observations during the site evaluation, the general condition of the project is fair. The deterioration which has taken place is normal and, with proper maintenance, should not affect the integrity of the structure.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures

The slide gates are usually opened in the Spring and Fall of the year in anticipation of the comparatively higher runoffs at these times.

4.2 Maintenance of Dam

There appear to be no definite maintenance procedures of the dam in effect.

4.3 Maintenance of Operating Facilities

The gates are apparently kept in working order. The owner stated that they were overhauled as recently as two years ago.

4.4 Warning System

There is no warning system.

4.5 Evaluation

The lowering of the pond level in anticipation of high runoff is an attempt, and probably all that can be done practically, to mitigate the effects of potential floods. Maintenance, while it does exist, could be improved upon. Recommendations for improving these conditions are given in Section 7.3.

SECTION 5

HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data. The hydraulic/hydrologic analysis was made in accordance with "Preliminary Guidance for Estimating Maximum Probable Discharges in Phase I Dam Safety Investigations", "Estimating Effect of Surcharge Storage on Maximum Probable Discharges", and "Rule of Thumb Guidance for Estimating Downstream Dam Failure Hydrographs" as furnished by the New England Division, Corps of Engineers and "Recommended Guidelines for Safety Inspection of Dams" as issued by the Department of the Army, Office of the Chief of Engineers.

U.S.G.S. Quadrangle maps were used to determine reservoir and drainage areas. Where practicable, spillway dimensions were obtained by direct measurement. Hydraulic coefficients were assigned on the basis of experience and engineering judgment.

b. Experience Data. No specific experience data with respect to the hydraulic/hydrological characteristics of the project are known to exist.

c. Visual Observations

The right abutment section appeared to be slightly lower than the left. Accurate measurements were not possible. For the purpose of hydraulic analysis, the right abutment was assumed to be one foot lower than the left. It was observed that high flows would obviously discharge over a length greater than the dam itself. A total effective length, including the spillway, of 427 feet was assumed. It is virtually impossible to determine where the embankment, or fill behind the retaining walls, ends and the natural abutments begin.

d. Overtopping Potential. A Probable Maximum Flood (PMF) of 10,970 cfs was determined. Owing to its intermediate size and significant hazard classifications, the PMF was used in the determination of the Peak Outflow (or test flood) of 9,300 cfs. The spillway capacity, before overtopping, is about 1,600 cfs and such a flow would overtop the right abutment by about 4 feet and the left abutment by about 3 feet. It is doubtful that the dam, especially the right abutment, could withstand overtopping for very long. At the test flood, however, the water level immediately downstream of the dam would be within a few feet of the spillway crest elevation, thus a failure of the dam would have little effect on the total discharge.

The Peak Failure Outflow, assuming a 50-foot breach in the right abutment, of 5,400 cfs combined with the spillway discharge at full pond, results in a flow of about 7,000 cfs.

Downstream of the dam is a highway bridge under which there is a channel of about 500 square feet. This may possibly act as a control section, but would have little influence on downstream conditions. As the flood flow enters the marsh, water levels could rise as high as El. 97, thus causing flooding and possible damage to low lying houses. Owing to receding grade and the effect of storage, the water level would gradually drop to about El. 95 in the second reach. This elevation could cause some flooding damage to some residences on Cobb Street and the easternmost homes located off Reservoir Avenue, but no hazard to human life. The third and fourth reaches dissipate the flow to a level of approximately El. 93. These reaches are in a broad, marshy flood plain, with little property damage possible. The fifth reach was assumed to end at Cross Street, which was assumed to be a broad-crested weir, backing water up to El. 90 throughout reach 5, flooding a few homes and a small factory. At this time, the peak would have dropped off greatly as the channel from Cross Street to the dam has upwards of 25 percent of the volume of the reservoir. The channel downstream of Cross Street could carry the outflow of reach 5 with a low potential of hazard to life and property.

The areas of impact immediately downstream of the dam are shown on the location map.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

- a. Visual Observations. Nothing was noted which would indicate that the dam was unstable.
- b. Design and Construction Data. No design or construction data are available.
- c. Operating Records. Not applicable.
- d. Post Construction Changes. No post construction changes are known to have been made.
- e. Seismic Stability. This dam is located in Seismic Zone 2 and therefore a seismic analysis is not required according to the recommended guidelines.

SECTION 7

ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. This almost 80-year old concrete and fill structure appears to be in fair condition. While there are signs of normal aging and deterioration, there are no indications of structural distress.

b. Adequacy of Information. The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and engineering judgment.

c. Urgency. The required repair and maintenance work should be accomplished within one to two years of the receipt of this report by the owner.

d. Need for Additional Investigation. There is no need for additional investigation.

7.2 Recommendations

Additional engineering investigations or major modifications to the dam are not required.

7.3 Remedial Measures

a. Alternatives. Not applicable.

b. Operation and Maintenance Procedures. The owner of the dam should develop and implement procedures which would include periodic inspection of the dam for signs of distress, deterioration or vandalism. Repairs and restorations should be made, where required, and the spillway should be periodically cleaned of growth and debris.

Presently required maintenance includes repair of spalled concrete and the clearing of growth and debris from the channel between the dam and the highway bridge downstream of the dam.

The right abutment should be brought to true grade and eroded areas on the downstream slope suitably filled. Removal of growth

would serve no purpose but would, rather, provide an opportunity for damage by motorbikes or other destructive forces.

Around the clock surveillance should be provided by the owner during periods of unusually heavy precipitation. The owner should develop a formal warning system with local officials for alerting downstream residents in case of emergency.

APPENDIX A

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT NORTON RESERVOIR

DATE JUNE 12, 1978

TIME 12:30 P.M.

WEATHER CLEAR & SUNNY

W.S. ELEV. 101 U.S. DN.S

PARTY:

1. J. Goodrich
2. D. Fischer
3. _____
4. _____
5. _____

| PROJECT FEATURE | INSPECTED BY | REMARKS |
|-----------------|--------------|---------|
| 1. _____ | | |
| 2. _____ | | |
| 3. _____ | | |
| 4. _____ | | |
| 5. _____ | | |
| 6. _____ | | |
| 7. _____ | | |
| 8. _____ | | |
| 9. _____ | | |
| 10. _____ | | |

1. _____
2. _____
3. _____
4. _____
5. _____
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7. _____
8. _____
9. _____
10. _____

INSPECTION CHECK LIST

PROJECT NORTON RESERVOIR

DATE _____

PROJECT FEATURE _____

NAME _____

| AREA EVALUATED | CONDITION |
|---|---------------|
| <u>DIKE EMBANKMENT (AT ENDS OF DAM)</u> | |
| Crest Elevation | |
| Current Pool Elevation | 101 |
| Surface Cracks | None |
| Pavement Condition | No pavement |
| Movement or Settlement of Crest | None |
| Lateral Movement | None |
| Vertical Alignment | O.K. |
| Horizontal Alignment | O.K. |
| Condition at Abutment and at Concrete Structures | O.K. |
| Indications of Movement of Structural Items on Slopes | NO MOVEMENT |
| Trespassing on Slopes | None |
| Sloughing or Erosion of Slopes or Abutments | |
| Rock Slope Protection - Riprap Failures | |
| Unusual Movement or Cracking at or near Toes | |
| Unusual Embankment or Downstream Seepage | |
| Piping or Boils | None |
| Foundation Drainage Features | |
| Toe Drains | No toe drains |
| Instruments on System | |

INSPECTION CHECK LIST

PROJECT NELTON RESERVOIR

DATE _____

PROJECT FEATURE _____

NAME _____

| AREA EVALUATED | CONDITION |
|---|--|
| CONCRETE DAM | |
| Concrete Surfaces | weathered some spalling on surface |
| Structural Cracking | None |
| Movement -- Horizontal & Vertical Alignment | None observed |
| Junctions | some Spalling and open joints |
| Drains -- Foundation, Joint, Face | none |
| Water Passages | - low level sluice - two outlets one discharging |
| Seepage or Leakage | - slight amount of seepage at outlet wing walls |
| Monolith Joints -- Construction Joints | |
| Foundation | |

INSPECTION CHECK LIST

PROJECT NORTON RECESSION

DATE _____

PROJECT FEATURE _____

NAME _____

AREA EVALUATED

CONDITION

OUTLET WORKS - INTAKE CHANNEL AND
INTAKE STRUCTURE

a. Approach Channel

Slope Conditions

Bottom Conditions

Rock Slides or Falls

None

Log Boom

None

Debris

None

Condition of Concrete Lining

some spalling

Drains or Weep Holes

None

b. Intake Structure

Condition of Concrete

Gate House

Stop Logs and Slots

O.K.

None

INSPECTION CHECK LIST

PROJECT NORTON RESERVOIR DATE _____

PROJECT FEATURE _____ NAME _____

| AREA EVALUATED | CONDITION |
|---|---------------------------------|
| <u>OUTLET WORKS - TRANSITION AND CONDUIT</u> General Condition of Concrete Rust or Staining on Concrete Spalling Erosion or Cavitation Cracking Alignment of Monoliths Alignment of Joints Numbering of Monoliths | <u>NOT</u> <u>APPLICABLE</u> |

INSPECTION CHECK LIST

PROJECT BELTON RESERVOIR

DATE _____

PROJECT FEATURE _____

NAME _____

| AREA EVALUATED | CONDITION |
|--|--------------------------------|
| <u>OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</u> | |
| a. Approach Channel | |
| General Condition | good |
| Loose Rock Overhanging Channel | none |
| Trees Overhanging Channel | none |
| Floor of Approach Channel | |
| b. Weir and Training Walls | |
| General Condition of Concrete | some spalling |
| Rust or Staining | some |
| Spalling | some |
| Any Visible Reinforcing | None |
| Any Seepage or Efflorescence | None |
| Drain Holes | None |
| c. Discharge Channel | |
| General Condition | fair |
| Loose Rock Overhanging Channel | none |
| Trees Overhanging Channel | none |
| Floor of Channel | good |
| Other Obstructions | debris & vegetation in channel |

INSPECTION CHECK LIST

PROJECT NORTON RESERVOIR DATE _____

PROJECT FEATURE _____ NAME _____

| AREA EVALUATED | CONDITION |
|--|-------------------|
| <u>OUTLET WORKS - CONTROL TOWER</u> | |
| Concrete and Structural | |
| General Condition | |
| Condition of Joints | |
| Spalling | |
| Visible Reinforcing | |
| Rusting or Staining of Concrete | |
| Any Seepage or Efflorescence | |
| Joint Alignment | |
| Unusual Seepage or Leaks in Gate Chamber | <u>NOT</u> |
| Cracks | <u>APPLICABLE</u> |
| Rusting or Corrosion of Steel | |
| Mechanical and Electrical | |
| Air Vents | |
| Float Wells | |
| Crane Hoist | |
| Elevator | |
| Hydraulic System | |
| Service Gates | |
| Emergency Gates | |
| Lightning Protection System | |
| Emergency Power System | |
| Wiring and Lighting System | |

INSPECTION CHECK LIST

PROJECT NORTON RESERVOIR

DATE _____

PROJECT FEATURE _____

NAME _____

| AREA EVALUATED | CONDITION |
|---|--------------------------------|
| <u>OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL</u> | |
| General Condition of Concrete | |
| Rust or Staining | |
| Spalling | |
| Erosion or Cavitation | |
| Visible Reinforcing | |
| Any Seepage or Efflorescence | |
| Condition at Joints | |
| Drain holes | |
| Channel | |
| Loose Rock or Trees Overhanging Channel | |
| Condition of Discharge Channel | debris & vegetation in channel |

INSPECTION CHECK LIST

PROJECT _____

DATE _____

PROJECT FEATURE _____

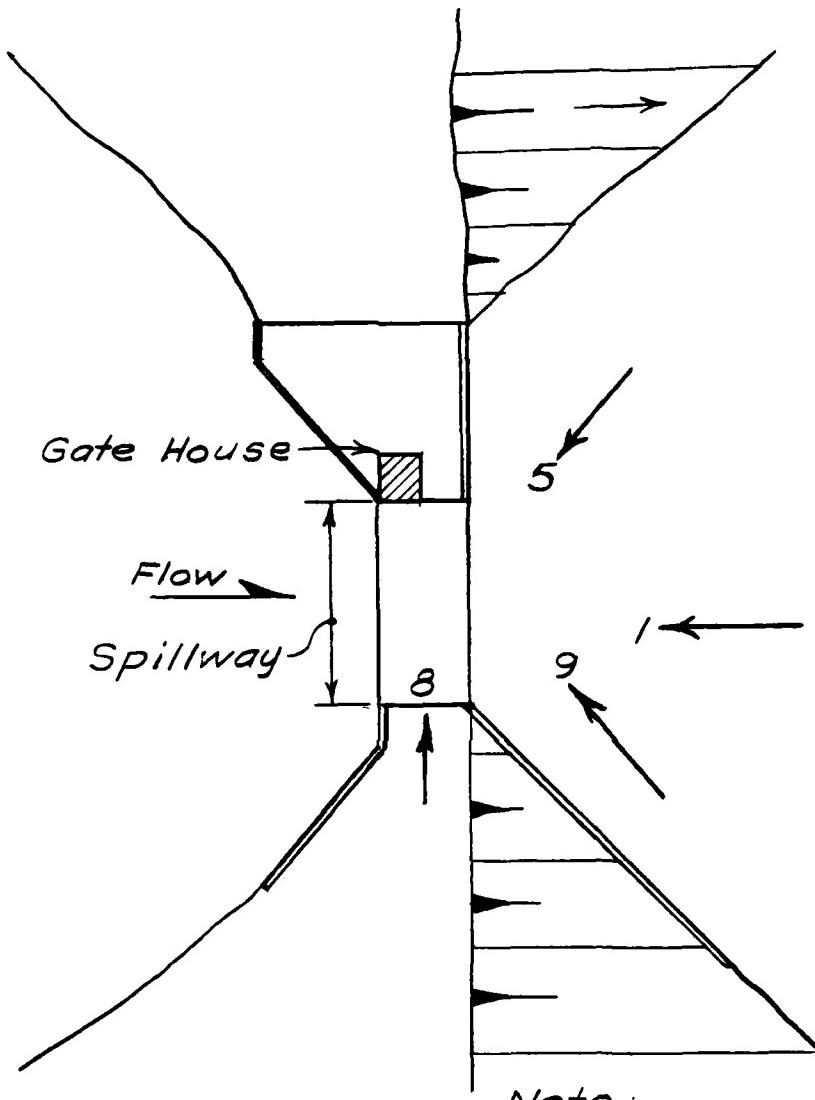
NAME _____

| AREA EVALUATED | CONDITION |
|--------------------------------------|-------------------|
| <u>OUTLET WORKS - SERVICE BRIDGE</u> | |
| a. Super Structure | |
| Bearings | |
| Anchor Bolts | |
| Bridge Seat | |
| Longitudinal Members | |
| Under Side of Deck | |
| Secondary Bracing | |
| Deck | <u>NOT</u> |
| Drainage System | <u>APPLICABLE</u> |
| Railings | |
| Expansion Joints | |
| Paint | |
| b. Abutment & Piers | |
| General Condition of Concrete | |
| Alignment of Abutment | |
| Approach to Bridge | |
| Condition of Seat & Backwall | |

APPENDIX B

No records of the design and construction
of this project were located.

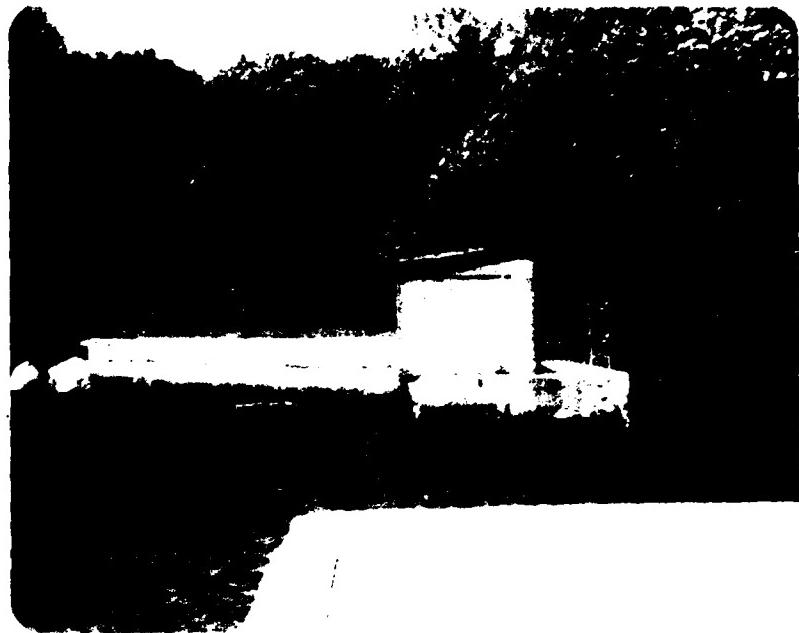
APPENDIX C



Note:
Nos. denote
direction of Photos.

PLAN

NORTON RESERVOIR



8

Left Abutment Looking Across Spillway



9

Left Abutment Looking Across Apron

NORTON RESERVOIR DAM



Downstream View of Dam



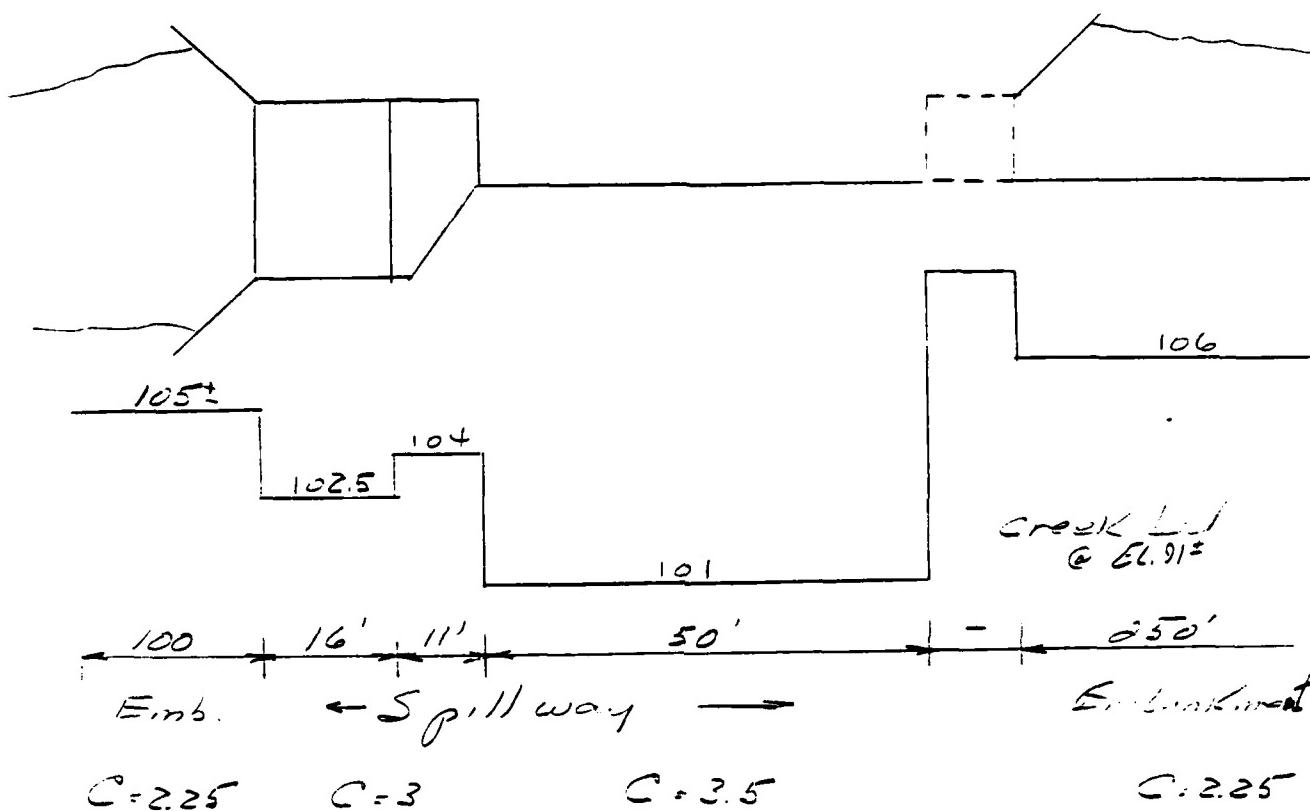
Right Bank Retaining Wall
looking Across Apron

NORTON RESERVOIR DAM

APPENDIX D

Client C of E Job No. _____ Sheet 1 of _____
 Subject NORTON RESERVOIR By _____ Date _____
 Ckd. _____ Rev. _____

$DMF = 10,970 \text{ cfs} = Q_p$,
 Reservoir Area = 600 acres
 Drainage area = $16.05 \text{ mi}^2 = 10,270 \text{ acres}$



Surcharge to pass $Q_{p1} = 8.3'$

$$STOR_1 = \frac{600 \times 8.3 \times 12}{10,270} = 5.82"$$

$$Q_{p2} - Q_{p1} (1 - STOR_1/12) = 10,970 \left(1 - \frac{5.82}{12}\right) \cdot 7.3 = \frac{5.12}{12}$$

Surcharge to pass $Q_{p2} = 7.3'$

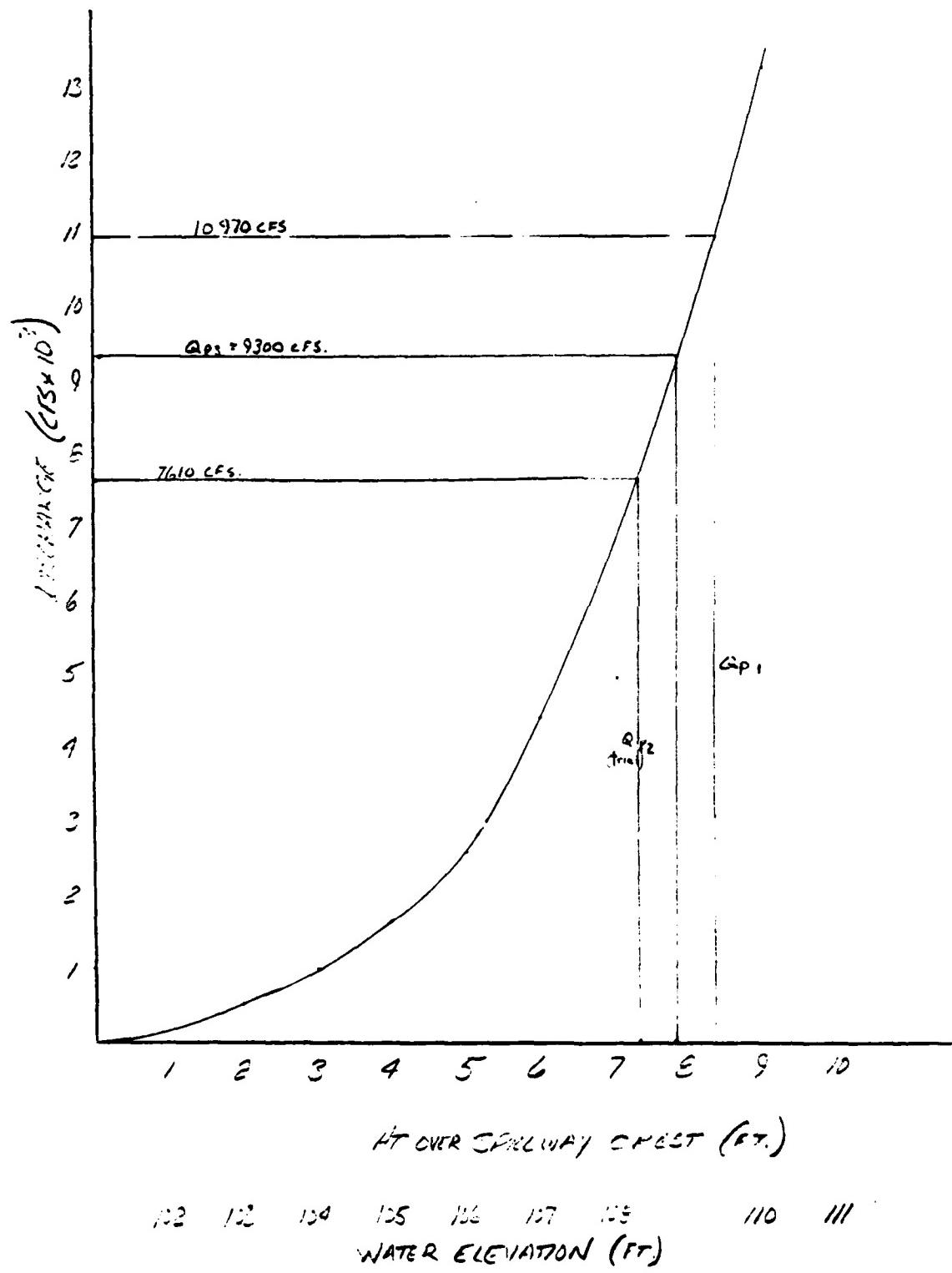
$$STOR_2 = \frac{600 \times 7.3 \times 12}{10,270} = 5.12" \quad \text{Av. } STOR = 5.47$$

$$\Delta \text{ Surcharge} = 5.47 \cdot 10,270 / 12 \times 12 = 7.3' \quad Q_{p2} \text{ is good}$$

Client C OF E
Subject NORTON

Job No. _____
By J. VEITCH Date 27 July 1978
Ckd. _____ Rev. _____

CHECKED



Client C OF E
Subject NORTON RES.

Job No. _____
By J. VETCH
Sheet 3 of _____
Date 2. JULY 1978
Ckd. _____ Rev. _____

STORAGE IN RES. (below crest) = $600 \text{ ac}(10') \cdot .5 = 3000 \text{ AC FT.}$

PEAK FAILURE OUTFLOW $y_0 = 16'$
 $w_b = \text{ASSUMING } 50\% \text{ RIGHT BANK} = 50'$

$$Q_{P_1} = \frac{8}{27} (50)(\sqrt{322})(16)^{1.5}$$
$$= 5,380 \text{ cfs.} + 1600 \text{ cfs} = 6980 \text{ cfs}$$

USING RATING CURVES. p. 5

(Test Flood)
CASE I: PMF OVER DAM (INTACT)

REACH #1 $Q_{P_1} = Q_{P_2} = 9300 \text{ cfs.}$ EL. = 97.8'

$$V_1 = \frac{7.8}{11} \left(\frac{9175}{93500} \right) 1500 = 102 \text{ AC FT.}$$

$$Q_{D_2}(\text{TRIAL}) = 9300 \left(1 - \frac{102}{3000} \right) = 8985 \text{ cfs.}$$

$$V_2 = \frac{7.6}{7.8} (102) = 99.4 \text{ AC FT}$$

$$V_{\text{AVE}} = 100.7 \text{ AC FT} \quad Q_{P_2} = 9300 \left(1 - \frac{100.7}{3000} \right) = 8990$$

$$\text{EL.} = 97.7'$$

REACH #2 $8990 = Q_{P_1}$ EL. 95.6

$$V_1 = \frac{7.6}{12} \left(\frac{7350}{93500} \right) 1000 = 106.9 \text{ AC FT}$$

$$Q_{D_2}(\text{TRIAL}) = 8990 \left(1 - \frac{106.9}{3000} \right) = 8665 \text{ cfs} \quad \text{EL.} = 95.4$$

$$V_2 = \frac{7.4}{7.6} (106.9) = 104.1 \text{ AC FT}$$

$$V_{\text{AVE}} = 105.5 \text{ AC FT}$$

$$Q_{P_2} = 8990 \left(1 - \frac{105.5}{3000} \right) = 8675 \text{ cfs}$$

Client C or ESubject NORTON RGS.

Job No.

Sheet 1 of _____By J VEITCHDate 28 JULY 1979

Chkd.

Rev.

REACH #3 $Q_{P_1} = 8675 \text{ cfs}$ $EL = 93.6$

$$V_1 = \frac{6.6}{8} \frac{5300(120)}{43560} = 120 \text{ ac ft}$$

$$Q_{P_2}(\text{TRIAL}) = 8675 \left(1 - \frac{120}{300}\right) = 8300 \text{ cfs} \Rightarrow EL 93.3'$$

$$V_2 = \frac{6.6}{8} (120) = 120 \text{ ac ft} \quad V_{\text{Ave}} = 127 \text{ ac ft}$$

$$Q_{P_2} = 8675 \left(1 - \frac{127}{300}\right) = 8310 \text{ cfs}$$

REACH #4. $Q_{P_1} = 8310 \text{ cfs}$ $EL = 90.9$

$$V_1 = \frac{5.7}{10} \frac{(7900) 120}{43560} = 128 \text{ ac ft}$$

$$Q_{P_2}(\text{TRIAL}) = 8310 \left(1 - \frac{128}{300}\right) = 7955 \text{ cfs.} \Rightarrow EL 90.7$$

$$V_2 = \frac{5.7}{10} (128) = 129 \text{ ac ft} \quad V_{\text{Ave}} = 126 \text{ ac ft}$$

$$Q_{P_2} = (8310) \left(1 - \frac{126}{300}\right) = 7960 \text{ cfs}$$

REACH #5 $Q_{P_1} = 7960$

$$L = 160 \text{ ft} \quad V_{\text{Ave}} = \frac{16}{12} (126) = 168 \text{ ac ft}$$

$$Q_{P_2} = 7960 \left(1 - \frac{168}{300}\right) = 7515 \text{ cfs.}$$

ASSUMING CROSS STR. AS THE CRISTED WEIR (NEGLECTING SLEEKET)
 $V \approx \frac{7515}{7960} \approx 1/\text{sec}$ $Q = CL \left(H - \frac{H^2}{2g}\right)^{1/2}$

$$\sqrt[1/2]{7515} - \frac{1^2}{69.9} \cdot H = 3.8' \quad \therefore \text{WATER FL CROSSING}$$

CROSS STR. REMAINING ≈ 90.9
IN REACH #5

Client C of E

Subject NORTON RES.

Job No.

Sheet 5 of _____

By J. VEITCH

Date 22/2/75

Ckd.

Rev.

- REACH #1. WATER EL REACHES. 97.8' @ FLOW OF 3200 CFS.
LOW LYING HOMES AROUND DAM & COAST. SUBJECT
TO FLOODING.
- #2 EL. 95.6 @ FLOW OF 5100 CFS. SLIGHT DANGER
OF PROPERTY DAMAGE TO SOME HOMES EAST OF
RESERVOIR AYE. NO SAFETY HAZARD.
- #3⁴ BY 500' DOWNSTM. OF DAM WATER LEVEL DOWNS TO
≈ 91.' CHANNEL OPENS TO LARGE, WIDE, FLOODPLAIN.
LITTLE PROPERTY DAMAGE POSSIBLE IN REACH #1
- #5 WATER EL. REMAINING @ ≈ 91.' FLOODING A
few HOMES & FACTORY ON CORNER. NO APPARENT SAFETY
HAZARD.

Client COFF

Job No.

Sheet 6 of

Subject NORTON RES.

By J. VERNER

Date 20-1-64

Ckd.

Rev.

CASE II PF.O. $Q_p = 6980 \text{ CFS}$
TO CURVES APP. 8 (neglecting Volume of channel)

REACH, EL. 95.6' Flooding to homes East side of
Coos st. No hazard to life.

II. 93.7 Some flooding possible but unlikely.
No hazard.

III. 91.6 No flooding or hazard.

Client CofE
Subject NORTON

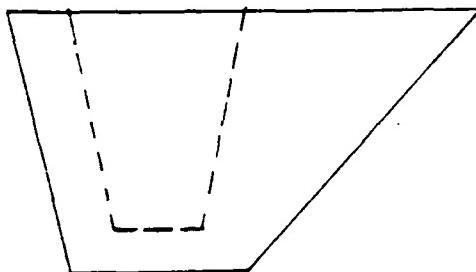
Job No. _____
By _____ Date _____
Ckd. _____ Rev. _____

$$\text{slope} = 5/5000 = .001 \pm$$

1" = 300' horiz.

$$5\frac{1}{2} \cdot .03$$

$$n = 0.05
C = 30$$



WP's

AREAS

| <u>@ 100</u> | <u>@ 95</u> | <u>To 100</u> | <u>To 95</u> | <u>@ DAM</u> |
|--------------|-------------|---------------|--------------|--------------|
| 300 | 225 | 2,250 | 930 | |
| 800 | 575 | 6,100 | 2,600 | 1500' dam. |

Av 550 400 4175 1765

REACH ① 1500' long

$$@ \text{EL. 95 } R = \frac{1765}{400} = 4.4 \quad R^{2/3} = 2.7$$

$$Q = ACR^{2/3}S^{1/2}, \quad 1765 \cdot 30 \cdot 2.7 \cdot 0.03 = 4300 \text{ cfs}$$

$$@ \text{EL. 100 } R = \frac{4175}{550} = 7.6 \quad R^{2/3} = 3.7$$

$$Q = 4175 \cdot 30 \cdot 3.7 \cdot 0.03 = 14,600 \text{ cfs}$$

Client

Cote E

Job No.

Sheet 8 of

Subject

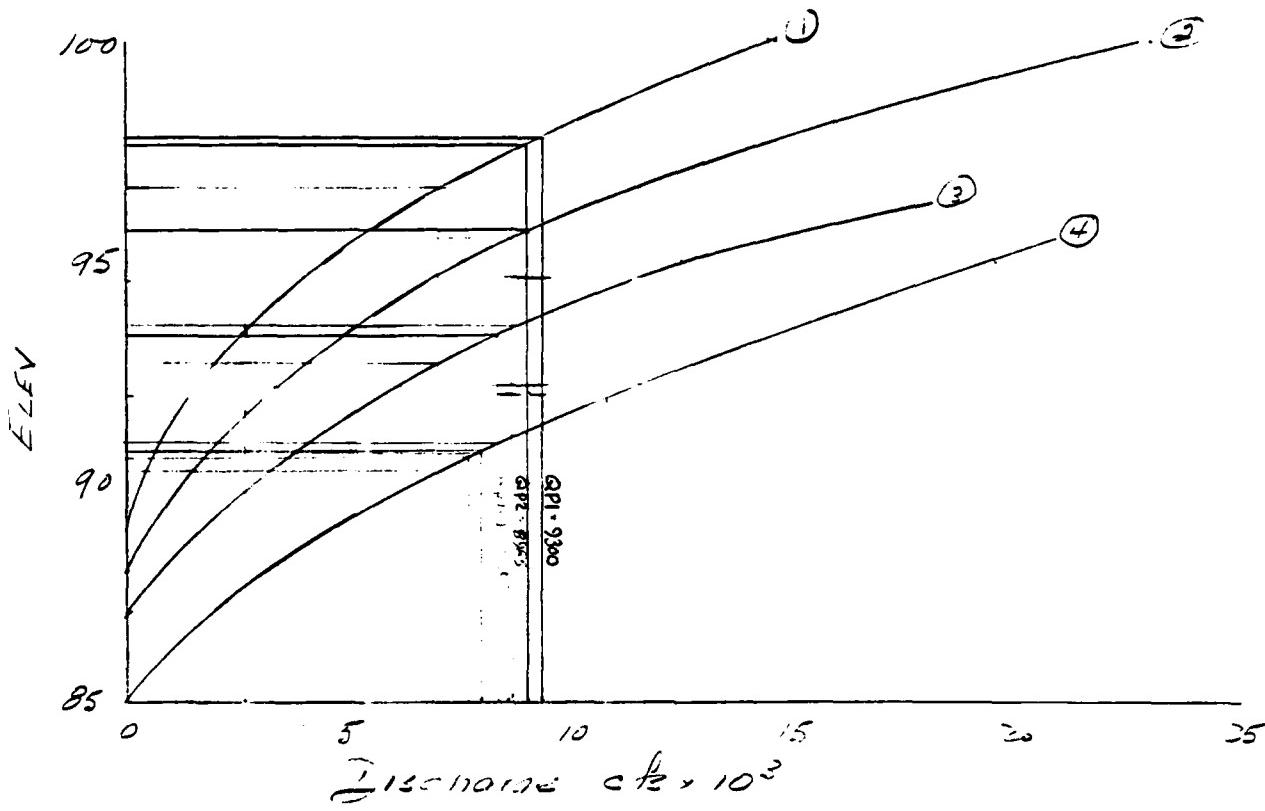
NORTON

By

Date

Ckd.

Rev.



Client

Col E

Job No.

Sheet 9 of

Subject

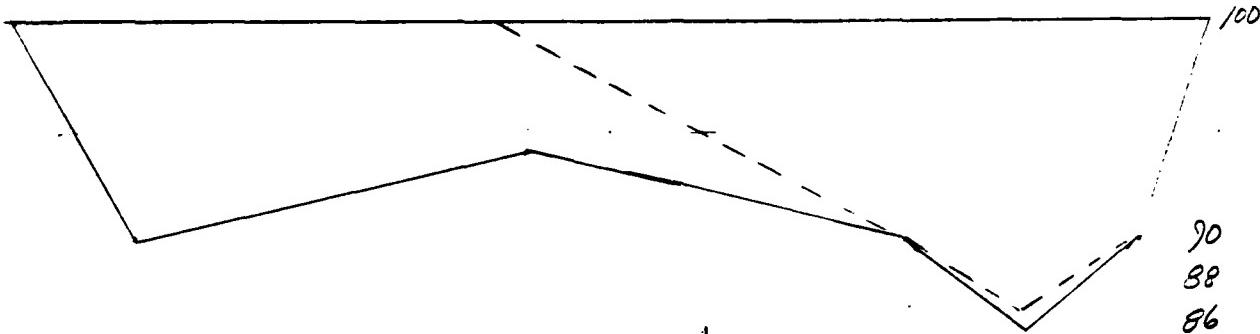
NORTON

By

Date

Ckd.

Rev.

WP's

| | |
|-------|------|
| @ 100 | C 95 |
| 1200 | 800 |
| 2000 | 1850 |

ABE, 15

| | |
|--------|-------|
| To 100 | To 95 |
| 8,600 | 3,600 |
| 16,600 | 7,000 |

-- 2500 D.S.
— 3800 D.S.

Av. 1600 1325 12,600 5,300 Reach 3.

Av. 1000 700 7,250 3,100 Reach 2

REACH ②

$$@ EL 95 \quad R = \frac{3100}{700} = 4.4 \quad T_2^{\frac{1}{2}} = 2.7$$

$$Q = 3100 \times 30 \times 2.7 \times .03 = 7,500 \text{ cu ft}$$

$$@ EL 100 \quad R = \frac{7350}{1000} = 7.35 \quad T_2^{\frac{1}{2}} = 3.5$$

$$Q = 7350 \times 30 \times 3.5 \times .03 = 32,000 \text{ cu ft}$$

REACH ③

$$@ EL 95 \quad R = \frac{5300}{1325} = 4.0 \quad T_2^{\frac{1}{2}} = 2.6$$

$$Q = 5300 \times 30 \times 2.6 \times .03 = 12,400 \text{ cu ft}$$

$$@ EL 100 \quad R = \frac{12600}{1600} = 7.9 \quad T_2^{\frac{1}{2}} = 3.4$$

$$Q = 12,600 \times 30 \times 3.4 \times .03 = 44,000 \text{ cu ft}$$

Client C of E Job No. _____ Sheet 10 of _____
 Subject NORTON By _____ Date _____
 _____ Ckd. _____ Rev. _____

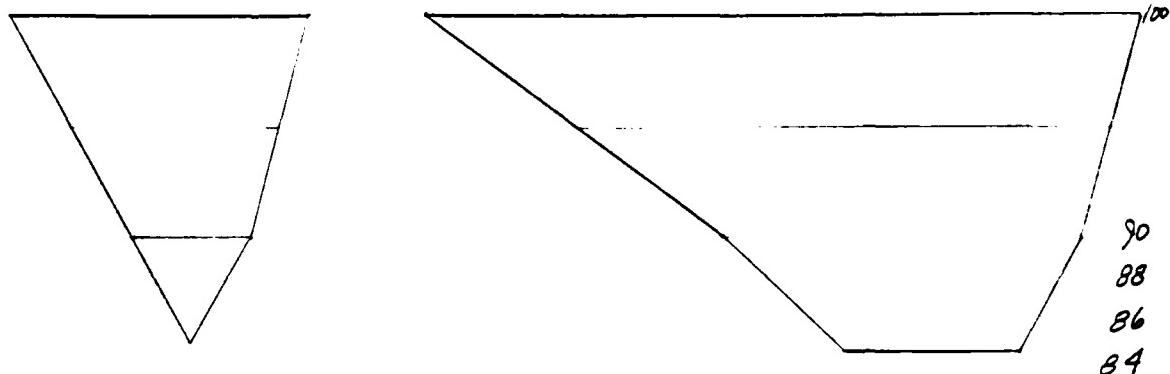
REACH 3 (length = 1300)

$$V_1 = \frac{7.6/8}{43,560} 5300 \times 1300 = 150 \text{ AF}$$

Total storage through REACH 3 : 400 AF

$$Q_{P2} (\text{trial}) = 11,500 \left(1 - \frac{290}{9400}\right) = 11,000$$

1" = 300' Long.



| | |
|-------------|-------------|
| <u>WP's</u> | |
| <u>@ 95</u> | <u>@ 90</u> |
| 1250 | 800 |

| | |
|-------------------|--------------|
| <u>AREAS</u> | |
| <u>To 95</u> | <u>To 90</u> |
| 7,900 | 2,750 |
| ——— 5300 ————— 25 | |

| | | | | |
|----------|-----|-------|-------|------------|
| Av. 1550 | 400 | 7,450 | 1,400 | 700 = 12.5 |
|----------|-----|-------|-------|------------|

REACH ④

$$\text{CEL. } 90 \quad T_2 \cdot \frac{1400}{400} = 3.5 \quad T_2^{2/3} = 2.5$$

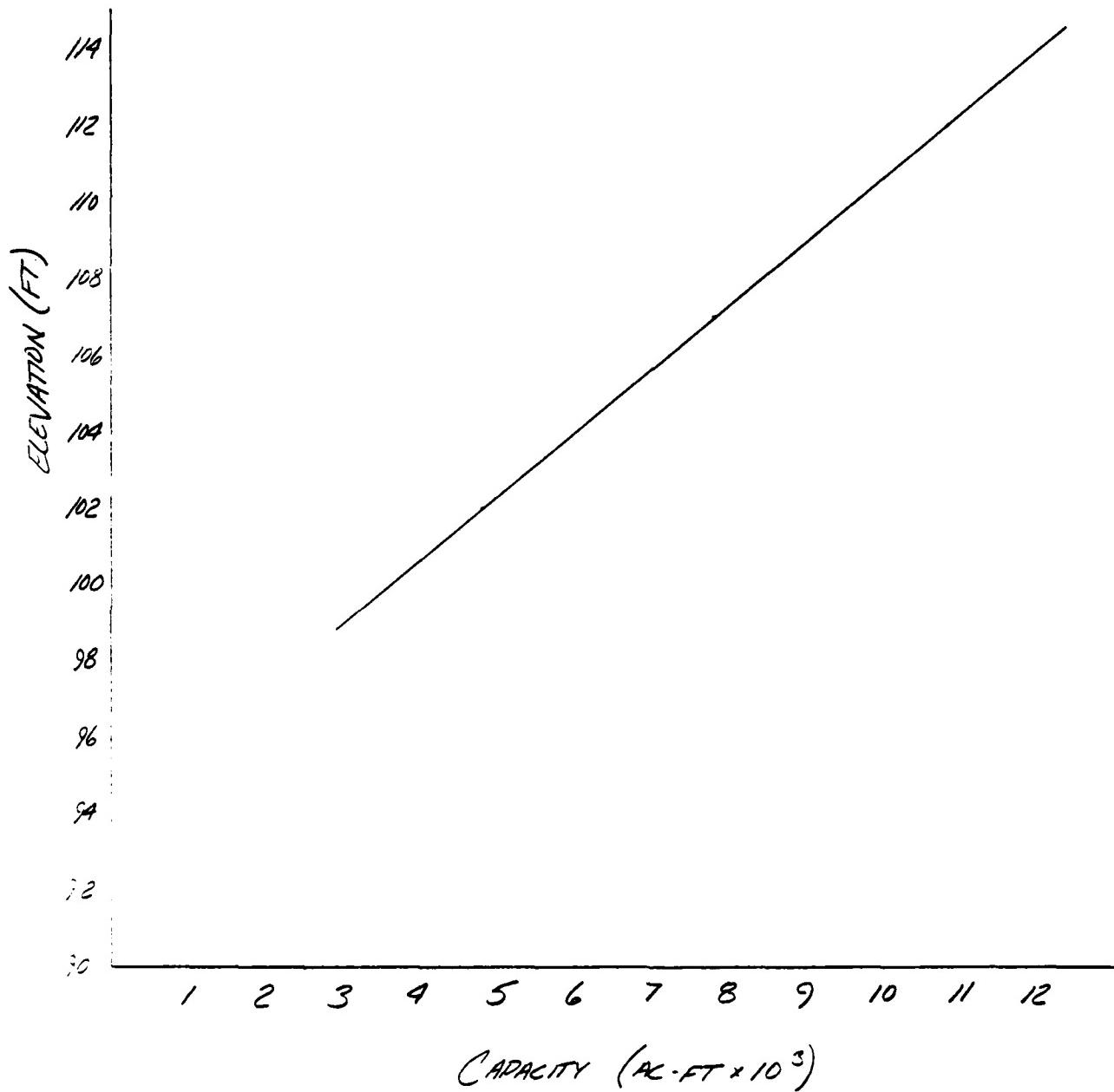
$$Q = 1400 \times 30 \times 2.5 \times .03 = 3,100 \text{ cfs}$$

$$\text{CEL. } 95 \quad T_2 \cdot \frac{7450}{1550} = 4.8 \quad T_2^{2/3} = 2.7$$

$$Q = 7450 \times 30 \times 2.7 \times .03 = 17,500 \text{ cfs}$$

Client CofE
Subject NORTON RES.
- CAPACITY CURVE -

Job No. _____ Sheet 1 of _____
By J. VEITCH Date 25 AUG 1978
Ckd. _____ Rev. _____



APPENDIX E
INFORMATION AS CONTAINED IN
THE NATIONAL INVENTORY OF DAMS

THE INFORMATION CONTAINED
IN THE NATIONAL INVENTORY OF
DAMS WILL BE FURNISHED BY THE
CORPS OF ENGINEERS TO BE BOUND
INTO THE REPORT AT A LATER DATE.

END

FILMED

7-85

DTIC